DOCUMENT RESUME

ED 288 457 HE 020 955

AUTHOR Chatman, Steve; Sprengel, Archie
TITLE A User-Based Response System for the Applied Research Needs of Comprehensive Outcomes Assessment Activities.
PUB DATE Nov 87
NOTE 20p.; Paper presented at the Annual Meeting of the Mid-America Association for Institutional Research (St. Louis, MO, November 1987).
PUB TYPE Reports - Descriptive (141) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Computer Oriented Programs; Higher Education; Information Needs; *Information Systems; *Institutional Research; *Outcomes of Education; Research Methodology; *Research Needs; State Universities; Statistical Analysis; User Needs (Information)
IDENTIFIERS *Decision Support Systems; *Southeast Missouri State University

ABSTRACT

The development of a computer-based decision support system for outcomes assessment at Southeast Missouri State University is described. A menu-driven, user-based retrieval and analysis and reporting system, the Statistical Analysis System (SAS) was designed. The decision support system incorporates two major components, research group identification/selection and selection of analytic techniques. The research group identification component constructs the necessary job control language and SAS DATA step actions. The design menu for identification/selection is presented and explanations are offered. The major analysis procedures are also identified. The constructed SAS program will be modifiable so that more sophisticated analyses can be performed. The user-based information system provides a controlled mechanism of automated access to student information files. It is suggested that without a data access and analysis system, the information needs of all disciplines and of the university will quickly overwhelm a small institutional research office leading to canned responses in the form of summary reports or reliance on national testing group reports, neither of which will adequately address the needs of faculty. (SW)

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ED288457

# A User-based Response System for the Applied Research Needs of Comprehensive Outcomes Assessment Activities

Dr. Steve Chatman, Director of Institutional Research

and

Mr. Archie Sprengel, Coordinator of Academic Computing Services

Southeast Missouri State University

November, 1987

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Presented at the annual meeting of the Mid-America Association for Institutional Research, St. Louis, MO

HE 020 955



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Under the direction of the President's Task Force on Outcomes Assessment, the general studies program and all academic programs at Southeast Missouri State University must include norm referenced tests in the demonstration of instructional outcomes. Support by institutional researchers might easily be overburdened because the diversity of research needs cannot easily be addressed by routine programmed response. The recommendations of a university ad hoc committee and the subsequent design of a menu-driven, user-based retrieval and SAS analysis and reporting system will be described.

## OUTCOMES ASSESSMENT AND THE OFFICE OF INSTITUTIONAL RESEARCH

Institutions facing the responsibility of demonstrating instructional outcomes are faced with many tasks and associated costs. Of the costs of assessment described by Ewell (1985a), instrument, administration, analysis and coordination, analysis costs are perhaps more likely to be the responsibility of offices of institutional research at mid-sized campuses. In fact, the Criteria for Accreditation of the Southern Association of Colleges and Schools "Planning and Evaluation (3.1)" section calls for

> "the development of procedures for evaluating the extent to which these educational goals are being achieved ... Procedures used to evaluate instructional programs may include: ... pre- and post-testing of students; surveys of recent graduates; surveys of employers of graduates; student scores on standardized examinations or locally constructed examinations; ... etc."

Followed by "Institutional Research (3.2)" directives to engage in continuing study, analysis and appraisal of their purposes, policies, procedures and programs, it would appear that the office of institutional research should have an active role in analysis of outcomes assessment information. But given the limited resources

available to institutional researchers, how might they respond? It is argued that a user-based information system can serve the research needs of the academic community more effectively than canned responses. This argument is supported by current reports on the effectiveness of outcomes measures in improving instructional effectiveness and by the tendency of interest in outcomes measures to vary over time. Further, it is argued that the summary reports suitable for institutionwide analyses are somewhat responsible for the limited impact of outcomes assessment.

This paper describes the initial development of a computer-based decision support system to aid faculty and administrative researchers in being able to respond effectively to the institution's need for information. It is assumed that without a data access and analysis system, the information needs of all disciplines and of the university will quickly overwhelm small offices of institutional research leading to canned responses in the form of summary reports or reliance on national testing group reports, neither of which will adequately address the needs of faculty.

The primary goal of outcomes assessment, to improve instruction, requires a system of faculty data access and analysis support that does not typically exist on university campuses and the absence of a suitable research support system limits faculty efforts to assess learning outcomes. The people directly responsible for instruction should have direct access to the information that is required to measure instructional effectiveness. It is felt that the absence of a research support system has discouraged faculty from direct and continued participation in outcomes research. Instead, faculty are likely to

respond to negative outcomes, celebrate positive outcomes, and largely ignore consistent findings.

A second reason to open access for faculty members is the practical motivation to distribute the responsibility for outcomes research across campus. Simply, more researchers exist on campuses outside of the administration that exist within the administration.

## CURRENT USES OF OUTCOMES ASSESSMENT INFORMATION

In addressing the instructional improvement effect of outcomes assessment, it has been suggested that "the mere act of collecting such information tends to focus institutional attention more directly on the teaching-learning process" (Astin, 1985) and that "the result has been increased faculty attention to and involvement with instruction and learning" (Ewell, 1985b). Specific instances of the effect of outcomes assessment on the improvement of instruction include changes resulting from the development of stated objectives of the curriculum (Banta, 1985) and changes resulting from negative test score information (Ewell, 1985b).

Focusing on the instructional effect of test score results, we have available few examples of the direct impact of outcomes assessment on learning. There are reported developmental improvements in student self-assessment (Loacker et al., 1985) and annual improvements in COMP score gains at Northeast Missouri State University (Ewell, 1986, p. 75). It should be noted that Jaschik reports test score improvements at Northeast following curricular changes (1985) although the results presented are insufficient to separate the effects of curricular change and higher student mean ACT scores.

The examples of less direct effects are more numerous and include a revision of mathematics instruction and psychology major requirements (McClain and Krueger, 1985; Jaschik, 1985), enforced consistency among faculty in teaching core courses, clear progression of courses from lower- to upper-division, increased faculty concern about the student's ability to apply knowledge, and changes in curricular requirements at the University of Tennessee at Knoxville (Banta, 1986). (For a more detailed listing of the curricular redesign effects of test score information at UTK, see Banta (1985, pp. 26-7).)

While supporting the value of curricular revision, increased faculty concern with instructional objectives, and changes in curricular requirements, to view them as measures of the positive impact of outcomes assessment is inconsistent with the motivation of outcomes assessment. Curricular change is not a demonstration of institutional effectiveness and the curricular changes mentioned need not have resulted from outcomes assessment. Outcomes assessment served as a useful curricular redesign causal agent but the changes could have resulted through more traditional program evaluation efforts.

The problem of increasing student learning is difficult and is not easily addressed by institutional research efforts. The above examples represent the hypothesized consequence of relying on large scale analyses and summary test score information suitable for newspaper release, presentation to regents and to state agencies.

## LIMITING THE USEFULLNESS OF OUTCOMES INFORMATION THROUGH LIMITED REPORTS

Simple test score profiles provide limited information and the cycle of national interest/disinterest in comprehensive testing (Banta, 1986) is a logical consequence of a continuing assessment costs yielding

largely stable results and is promoted by limited, summary information. Simply, summary information is useful for institutional comparisons and related brief statements and, unless lower than anticipated, does not lead to intervention and experimentation. It is argued that a program of research activities concerning outcomes assessment is more likely to yield continued interest in outcomes assessment. By linking outcomes information to the computerized academic records, research programs become more likely.

Traditional group test score reports permit few conclusions. We are frequently able to judge the relative performance of our students with other students, the relative performance of some gender or ethnic groups, the growth in our students over time, and to some extent, change in the relationship between major variables over time. By analyzing test content and/or subscores we may also discover academic areas of weakness. But are these results rich enough to answer the questions of a concerned faculty with research skills and experience in the subtle relationship of student and instruction? Based on the research desires of a university ad hoc committee at Southeast, summary reports would not meet their needs.

Briefly, discussion among ad hoc members and between members and their peers produced a variety of information needs that would exceed the capabilities of the office of institutional research in that they exceeded the capabilities of standard reports. Faculty members were interested in covariate studies, cross-tabulation by grouped high schools, relationship between test scores and introductory course performance, course to course comparisons, etc. Addressing these needs for even one academic major would be an additional burden for

institutional research. To address these needs for all majors would be prohibitive.

This paper is an extended analysis of the ad hoc committee's subsequent recommendation that an interactive menu-based system of data retrieval and analysis be developed (Office of the Provost, October 1987). The system is to serve a decision support function in that it will fully open the academic database to representatives of each department in a manner that protects student privacy. The system uses selection menus to define the research group(s) and analysis technique(s) and produces a SAS program that accomplishes the analysis reports the results.

## THE DECISION SUPPORT SYSTEM

As described by Sheehan (1984) in reference to Sprague and Carlson's (1982) nomenclature, specific decision support systems are the hardware and software components that support decision makers efforts within specific areas and with the following objectives:

> "to support (1) hard, unspecified, or unstructured decisions as well as structured decisions; (2) decision making at all levels of the organization and the integration between levels where appropriate; (3) the communication between decision makers so as to support independent decision making; (4) all phases of the decision-making process and the facilitation of interaction between the phases; (5) a variety of decision-making processes but the nondependence on any one; and (6) ease of use and modification in response to changes in the user, the task, or the environment" (Sheehan, 1984; p. 202).

The design of specifications for a specific decision support system for outcomes assessment would attempt to address these objectives by: (1) supporting a broad range of analytic techniques and retrieval supports as well as broadly accessing the student database; (2) opening access to researchers at several levels of the university structure and to

researchers in student services; (3) using a common database to insure consistency; (4) providing general retrieval and analysis support; (5) supporting several analytic techniques; and (6) using a screen menu format.

The programming requirements of a locally developed system would be prohibitive. Instead, the committee decided to rely on SAS access, analysis and reporting capabilities and to therefore focus on building a system that would support users in the creation of SAS programs. The resulting decision support system incorporates two major components, research group indentification/selection and selection of analytic techniques. The research group identification component constructs the necessary JCL and SAS DATA step actions.

The design menu for identification/selection appears below.

```
                    ACADEMIC OUTCOMES RETRIEVAL AND REPORTING SYSTEM

DATA SELECTION: SELECT SUBGROUPS INDICATED (WITHIN CATEGORIES)
                TO RECEIVE ADDITIONAL INFORMATION, MOVE THE CURSOR TO
                THE LOCATION OF THE INFORMATION IN QUESTION AND PRESS F1.

   TEST SCORES ______      ______      ______      _____      _____
   TEST DATE   __/__/__    __/__/__    __/__/__    __/__/__   __/__/__

STUDENT CHARACTERISTICS

CURRENT        ____      CLASS          __ BEGFROSH      ADM STATUS __ REGULAR
MAJOR(S)       ____      @ TESTDATE     __ FRESHMEN      SORT BY _  __ PROVISI
                ____                    __ SOPHOMORE
SORT BY _      ____      SORT BY _      __ JUNIOR        GENDER        __ MALE
                ____                    __ SENIOR        SORT BY _     __ FEMALE
                                        __ SPECIAL

DEGREE(S)      __ BA                                     ETHNIC        __ BLACK
OBJECTIVE      __ BS      TENURE          __  < 30 HRS   SORT BY _    __ FOREIGN
SORT BY _      __ BSED    W/ SOUTHEAST    __ 30-59 HRS                __ HISPANIC
                                          __ 60-89 HRS                __ WHITE
                          SORT BY _       __  > 90 HRS

CURRENT        __ BEGFROSH                              MAJOR(S)      ____
CLASS          __ FRESHMEN                              @ TESTDATE    ____
                __ SOPHOMORE                                           ____
SORT BY _      __ SENIOR                                SORT BY _     ____
                __ SPECIAL                                             ____
```

If subgroup labels are selected then the data stream will select only those subgroups indicated. For example, to limit analysis to regularly admitted students, an "x" should be placed immediately before "REGULAR" admission status (ADM STATUS). If restrictions are not desired, then the subgroup labels should not be flagged. Because the restrictions are sequential, combinations of flagged subgroups will identify rather specific groups.

The "SORT BY" field of each variable group causes output to be sorted by the subgroup values. For example, to sort by current classification, the user should flag the sort by field of "CURRENT CLASS." Subgroup selection and output sorting may be combined.

The following example of a completed screen restricts data to GRE mathematics and analytic scores from the 22nd of April, 1987 and ACT mathematics test scores of seniors (at test date). Furthermore, the analysis is restricted to students with at least 60 credit hours earned at Southeast and to majors 110, 120 and 130.

```
   TEST SCORES GREA_          GREMA_          ACTMA_          _____          _____
   TEST DATE   _4 /22 /87     _4 /22 /87      __ /__ /__      __ /__ /__     __ /__ /__

STUDENT CHARACTERISTICS

CURRENT          ____      CLASS            __ BEGFROSH      ADM STATUS __ REGULAR
MAJOR(S)         ____      @ TESTDATE       __ FRESHMEN      SORT BY _  __ PROVISI
                 ____                       __ SOPHOMORE
SORT BY _        ____      SORT BY _        __ JUNIOR        GENDER     __ MALE
                 ____                       X_ SENIOR        SORT BY _  __ FEMALE
                                            __ SPECIAL

DEGREE(S)        __ BA                                       ETHNIC     __ BLACK
OBJECTIVE        __ BS     TENURE           __  < 30 HRS                __ FOREIGN
SORT BY _        __ BSED   W/ SOUTHEAST     __ 30-59 HRS     SORT BY _  __ HISPANIC
                                            X_ 60-89 HRS                __ WHITE
                           SORT BY _        X_  > 90 HRS

CURRENT          __ BEGFROSH                                 MAJOR(S)   0100
CLASS            __ FRESHMEN                                 @ TESTDATE 0110
                 __ SOPHOMORE                                           0120
SORT BY _        __ SENIOR                                   SORT BY _  ____
                 __ SPECIAL                                             ____
```

SAS translation:

```
IF (TSTTYPE = 'GREA' OR TSTTYPE = 'GREMA')                          AND
   (TSTDATE = '042287' OR TSTDATE = '042287')                       AND
   (TSTMAJOR = '0100 OR TSTMAJOR = '0110' OR TSTMAJOR = '0120') AND
   ((SEMOHRS GE 60 AND SEMOHRS LE 89) OR (SEMOHRS GE 90))       AND
   (CLASS = '05');
```

Notice that the relationships between categories are restricted to observations fitting both definitions (and) while observations may fit either definition within a category (or).

The second major component of the information system, the analysis component, consists of an analysis type node and respective branches. The nodal screen is listed below and defines the major analysis procedures to be used.

ACADEMIC OUTCOMES RETRIEVAL AND REPORTING SYSTEM

STATISTICAL ANALYSIS OPTIONS (SELECT OPTION(S))

___ DESCRIPTIVE STATISTICS

___ COURSE TO COURSE CROSS-TABULATIONS

___ CORRELATIONAL STATISTICS

___ REGRESSION STATISTICS

___ ANALYSIS OF VARIANCE

___ GAIN SCORE ANALYSIS

___ RESIDUAL ANALYSIS (KNOWN REGRESSION)

LEVEL1 TITLE: _____

An example of a completed screen for regression analysis is presented below.

ACADEMIC OUTCOMES RETRIEVAL AND REPORTING SYSTEM

STATISTICAL ANALYSIS OPTIONS (SELECT OPTION(S))

| | |
|---|---|
| ___ | DESCRIPTIVE STATISTICS |
| ___ | COURSE TO COURSE CROSS-TABULATIONS |
| ___ | CORRELATIONAL STATISTICS |
| _X_ | REGRESSION STATISTICS |
| ___ | ANALYSIS OF VARIANCE |

LEVEL1 TITLE: AN_EXAMPLE_OF_USER_SUBMITTED_REQUESTS_____

The user is then branched to the appropriate analysis screen for further information. Following the current example of a regression analysis, the respective analysis screen would appear as follows.

ACADEMIC OUTCOMES RETRIEVAL AND REPORTING SYSTEM

REGRESSION STATISTICS
LEVEL2 TITLE: _____

| OUTCOME MEASURE | = | PREDICTIVE MEASURE | LEVEL3 TITLE |
|---|---|---|---|
| _____ | = | _____ | _____ |
| _____ | = | _____ | _____ |
| _____ | = | _____ | _____ |
| _____ | = | _____ | _____ |
| _____ | = | _____ | _____ |

The user would specify the appropriate simple regressions to examine.

ACADEMIC OUTCOMES RETRIEVAL AND REPORTING SYSTEM

REGRESSION STATISTICS
LEVEL2 TITLE: PREDICTIVE_STRENGTH_OF_INCOMING_MEASURES____

| OUTCOME MEASURE | = | PREDICTIVE MEASURE | LEVEL3 TITLE |
|---|---|---|---|
| GREMA | = | ACTMA | _____ |
| GREA_ | = | ACTMA | _____ |
| _____ | = | _____ | _____ |
| _____ | = | _____ | _____ |
| _____ | = | _____ | _____ |

Examples of other analysis branches are listed below.

ACADEMIC OUTCOMES RETRIEVAL AND REPORTING SYSTEM

COURSE TO COURSE CROSS-TABULATIONS
LEVEL2 TITLE: _____

| | COURSE | _____ | _____ | _____ | _____ | _____ |
|---|---|---|---|---|---|---|
| | SECTION | _____ | _____ | _____ | _____ | _____ |
| | SEMESTER | __ _ | __ _ | __ _ | __ _ | __ _ |
| CROSS WITH | | A B C D F | A B C D F | A B C D F | A B C D F | A B C D F |
| _____ | (N) | - - - - - | - - - - - | - - - - - | - - - - - | - - - - - |
| _____ | % | - - - - - | - - - - - | - - - - - | - - - - - | - - - - - |
| ____ | | | | | | |
| _____ | | | | | | |
| _____ | | | | | | |
| ____ | | | | | | |
| _____ | | | | | | |
| _____ | | | | | | |
| ____ | | | | | | |
| _____ | | | | | | |
| _____ | | | | | | |
| ____ | | | | | | |

ACADEMIC OUTCOMES RETRIEVAL AND REPORTING SYSTEM

ANALYSIS OF VARIANCE
LEVEL2 TITLE: MEAN DIFFERENCES

| OUTCOME MEASURE | = | CLASS VARIABLE | LEVEL3 TITLE |
|---|---|---|---|
| GREMA | = | MAJOR | _____ |
| GREA | = | MAJOR | _____ |
| _____ | = | _____ | _____ |
| _____ | = | _____ | _____ |
| _____ | = | _____ | _____ |

The user's response to the various analysis branch screens then creates appropriate SAS procedure statements to perform the analysis and produce the report.

The user-based information system serves as a controlled mechanism of automated access to student information files. The peculiarities of tape access and of SAS/DL1 interfaces are handled by the interactive system. Furthermore, by controlling access to the system and the input stream, student privacy can be insured. It should also be noted that the constructed SAS program will be modifiable so that more sophisticated analyses can be performed.

A similar menu-driven system currently exists on the campus at Southeast for the submission of flexible standard reports (JEMS) and especially for preparation of mailing labels and for enumerative information (ASAP). The system was developed primarily by Archie Sprengel.

## SUMMARY

History shows periodic interest in outcomes assessment. More recent reports of the impact of outcomes assessment on instructional improvement have frequently emphasized the curricular changes resulting from negative scores. When faced with the continuing burden of outcomes assessment, it may be reasonable to assume that interest will again die down as results become more consistent. It was argued that, to some extent, the lack of continuing programs of instructional research is due to the brief nature of canned analyses and that the diversity of information needed for faculty to pursue the less obvious findings requires a user-based information access and research support system. An example of such a decision support system is the menu driven SAS program writer described.

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OUTCOMES ASSESSMENT PLAN
FOR
SOUTHEAST MISSOURI STATE UNIVERSITY

I. **University Studies (General Education)** - Designated by the Regents as a Premier Program of the University.

A. **ACT Composite Score.**

1. **Fall 1986 and each succeeding semester:** administer to **all freshmen** to provide baseline data for comparison with ACT COMP.

B. **ACT COMP** (College Outcomes Measurement Program).

1. **Spring 1987, Fall 1987, Spring 1988:** administer to **sample of seniors and sophomores** to provide data base for comparison of present General Education with new University Studies program.

2. **Spring 1990 and each succeeding spring:** administer to **sophomores.**

3. **Spring 1992 and each succeeding spring:** administer to **seniors.**

C. **Institutionally Developed Instruments**

Focusing on the program's nine General Objectives and three Perspectives, outcomes measures are to be incorporated into the design of each course approved by the University Studies Committee. The Director of University Studies shall coordinate the assessment procedures so that appropriate summary results are available for the program as a whole.

II. **Writing Across the Curriculum** (Already University policy).

A. Students without credit in English composition applicable to a degree at Southeast Missouri State University are required to take the English Writing Skills Placement Test administered by the Department of English. On the basis of this test, students are placed in the appropriate developmental or college-level composition course or (if the score is high enough) may be given credit for EN 100 English Composition I or/and EN 150 English Composition II.

B. Students entering the University during the 1985-86 academic year or thereafter are required to pass a test of writing competence after they have completed 75 semester hours of credit. This test is administered by the Writing Outcomes Program. A passing score on this test is a requirement for graduation and is applicable to all baccalaureate degrees.

III. **All Academic Majors.**

A. **Fall 1987** (pilot Testing):
**Fall 1988** (fully implemented):
Norm-referenced evaluation process that allows for national/regional comparisons.

B. **Fall 1987** (pilot testing):
**Fall 1988** (fully implemented):
Evaluation based on programmatic goals as defined by academic departments, using (as appropriate) locally developed tests, performance evaluations, alumni surveys, etc.—any combination of techniques that may assist in determining whether a department's objectives for education of its majors are being successfully met.

IV. **Teacher Education** - Designated by the Regents as a Premier Program of the University.

A. **DESE-mandated entrance examination** (still under development).

1. **Fall 1988** and each succeeding semester.

B. **NTE Specialty Area Tests** (or other appropriate measure).

1. **Fall 1986 and each succeeding semester:** all secondary education majors.

2. **Spring 1987, Fall 1987, Spring 1988:** sample of Elementary Early Childhood and Exceptional Child education majors.

3. **Fall 1988 and each succeeding semester:** all education majors.

C. **NTE Test of Professional Knowledge.**

1. **Spring 1987, Fall 1987, Spring 1988:** sample of all education majors.

2. **Fall 1988 and each succeeding semester:** all education majors.

D. **DESE-mandated exit examination** (still under development).

1. **Fall 1991:** all seniors in teacher education.

V. **Follow-up Studies of Alumni**

The University will annually seek external judgement of its contribution to the intellectual and personal development of alumni through survey research.

VI. **Review:** The assessment plan adopted by the University shall be monitored by this task force or by another body established for the purpose; at intervals no longer than five years, the plan shall be thoroughly reviewed, and modified as necessary, to insure that it continues to serve the purposes for which it was instituted.

Submitted by the President's Task Force on Outcomes Measures, March 6, 1987.

Frank Adams
Linda Burns
Steve Chatman
Larry Clark
Robert Empie
Don Froemsdorf
Tracy Lange
Glenda McGaha
Bruce Parrish
James Ricks
Gary Rust
Fred Snider

Bill Stacy and Milford Holt
Co-Chairpersons

SOUTHEAST MISSOURI STATE UNIVERSITY
Cape Girardeau, Missouri 63701
(314) 651-2000

**TO:** Deans and Chairpersons

**FROM:** Milford O. Holt, Associate Provost MOH

**DATE:** October 19, 1987

**SUBJECT:** Storage/Retrieval System for Student Outcomes Assessment Data

Attached is a description of the institutional Storage/Retrieval System for Student Assessment Outcomes Measures. The task force that designed the system included Win Bruhl, Steve Chatman, Sharon Coleman, Greg Dickey, Vic Gummersheimer, Ken Heischmidt, John Hinni, Dennis Holt, Jane Kelly, William Zeller, and myself. The system has been assigned a number one priority for development in the Computer Center during the spring semester 1988. It will be on line beginning with the fall semester 1988.

If you or any of your faculty wish to have further information, contact Steve Chatman, Director of Institutional Research (EX 2523).

lk

Attachment

c: Task Force members
Executive Council
Faculty Senate

# STORAGE/RETRIEVAL SYSTEM
# FOR
# STUDENT OUTCOMES ASSESSMENT DATA

## I. Data Security, Access and Storage

a. Measures of academic progress and student development, collected to improve the effectiveness of academic programs, will be centrally maintained as an integral part of the academic record.

b. Data entry services will be provided by a single office or unit that will be responsible for the accuracy of the information. Manual data entry and modification of outcomes measures will be limited to this office.

c. The student database will be modified to include storage of limited alumni employment information as a measure of academic outcome. (Record will include job title, employer's name and address, and date information was last averified.) Any effort to contact the employer must follow a request for permission from the alumnus/alumna at that time.

d. The student database will be modified to include storage of student activities information as measures of student development. (Record will include semester, activity, honors or awards, and offices held.)

e. Student outcomes assessment data will carry protections equivalent to the protections given course grades. Access to individual records will be limited to chairpersons, deans and academic administrators.

f. The Office of Institutional Research will work with the Computer Center to determine data base segment specifications and on-line display designs.

## II. Data Retrieval and Reporting

An interactive menu-based system of data retrieval and anlysis will be developed. It will be menu-driven interactive support that creates SAS programs for data retrieval, analysis and reporting. Chairpersons, deans and academic administrators will have access to the supportive system. The Office of Institutional Research will work with the Computer Center to develop this interactive user-based system.

**Office of the Provost**
**October 1987**